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TRANSMISSION AND RECEIVING APPARATUS WITH ANTENNA

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TRANSMISSION AND RECEIVING APPARATUS WITH ANTENNA

[Appareil d'émission et de réception à antenne]

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The invention relates to wireless transmission and receiving apparatus the casing of which carries a microphone and an earpiece respectively placed in such a way as to be near the mouth and the ear in normal use position and contains active electronic circuits for transmission-receiving at radio frequency. A particularly important though not exclusive application of it is in so-called "wireless" telephones comprising a handset provided to held with the hand, constituting a transmission and receiving apparatus whose connection with the base containing the components for connection with the network is effected by the wireless method.

Only a few current apparatuses of the type defined above have a frame antenna incorporated in the casing. The majority have a whip or telescopic antenna which projects upward in the normal use position of the apparatus. This choice comes from a number of reasons. For frequencies ranging up to approximately 500 MHz, the length of the antenna is such that it is difficult to house it in a casing of acceptable size. An antenna housed in the casing is close to the active electronic circuits, so that the antenna picks up stray signals generated by these circuits, and the radiation of the antenna, during transmission, risks disturbing the functioning of the

circuits of the casing. Finally, the arrangement with the antenna projecting upward allows one to increase the range, especially for high frequencies.

The invention has its origin in several observations. In many applications, the search for a wide range is unnecessary, and it is sometimes even desirable to avoid an excess range: this is the case, for example, for apparatuses used inside a building or in an urban area. With the antenna placed beside the earpiece, it can be barely a few centimeters from a metallic side member of spectacles when the earpiece is flattened against the ear. This proximity greatly modifies the radiation diagram of the antenna. Finally, if the apparatus has significant transmission power, the presence of the antenna near the earpiece and above puts the brain and the eyes of the user in an elevated radio frequency field.

The present invention aims to eliminate these problems, which implies overcoming the currently entrenched presumption that it is necessary to place the antenna projecting upward. It proposes an apparatus whose antenna is placed so as to project downward from the casing in normal use position of the apparatus.

Under these conditions, whether the antenna is near the mouth or clearly projecting downward, it is always separated from any metallic element.

In a first embodiment of the invention, the antenna is of the whip type: it can then be mounted, for example, on a ball joint allowing one to bring it back along the casing in storage position; it can also be telescopic and retracted in the casing during period in which the apparatus is not used. In another embodiment, the antenna is at least partially contained in a pivoting flap, that swings or slides downward from its resting position (occupied outside of use periods of the apparatus) to its normal use position.

The invention will be better understood upon reading of the following description of some particular embodiments that are given as non-limiting examples. The description refers to the accompanying drawings in which:

-Figure 1 is a schematic diagram showing a possible arrangement of a whip antenna on a handset casing, according to a particular embodiment of the invention;

-Figure 1A shows a variant in detail of the handset of Figure 1;

-Figures 2, 3 and 4 show embodiment variants schematically oblique view.

-Figures 5A, 5B and 5C schematically show possible forms of symmetric antennas which can be used in flaps of the type shown in Figures 2, 3 and 4.

-Figures 6A and 6B schematically show forms of asymmetric antennas which can be used in a flap of the type shown in Figures 2, 3 or 4.

-Figure 7 shows an electrical diagram representing a possible circuit for antennas.

The radio-telephone handset shown in Figure 1 has rigid casing 10 in which are placed microphone 12, earpiece 14 and the usual electronic circuits for transmission and receiving

permitting modulation of a transmission carrier wave towards the circuits contained in base 16 and demodulation of the signals received from a carrier wave transmitted by the base. Casing 10 carries matched antenna 18, mechanically connected to casing 10 by ball joint 20 placed near the microphone, in such a way that the antenna can be moved between a position of use in which it projects downward (in solid lines in Figure 1) and a resting position in which it is raised along the casing (dashed line). In general, one will seek to give antenna 18 and the casing roughly the same length for reasons of space requirement. A length of around fifteen centimeters is appropriate for a carrier wave frequency between 200 and 1,000 MHz. The antenna is connected to the electronic circuits by flexible conductors which are not represented.

In an embodiment variant (Figure 1A), antenna 18 is attached to casing 10 of the base in an unmovable position, projecting downward, and surrounded by sleeve 22 made of insulating material, for example, made of elastomer, with no pointed part, which prevents risks of accident and limits the risks of catching.

Yet another embodiment variant consists of providing antenna 18 which does not pivot but which is telescopic, which can be retracted inside of the casing during periods of non-use and can be drawn downward for use. This antenna can also be provided so as to control, by its movement, switching of any nature such as turning on or an antenna changeover.

The frequencies used depend on the nature of the apparatus.

In the case of a "Pointel" type cellular radiotelephone apparatus, of a GSM standard European apparatus, or of an apparatus intended for other analog networks, the frequency will generally be on the order of 900 MHz. The corresponding wavelength is then 33 centimeters in the air, which leads to a half-wave antenna of 16.5 centimeters, which is compatible with the usual casings.

In the case of future radiotelephone apparatuses, the frequency used will often be on the order of 1.8 GHz, which translates into a matched antenna which is half as long and allows the embodiment variants which will now be described to be adopted more easily.

In the embodiment variant shown in Figure 2, in which the elements corresponding to those of Figure 1 are designated by the same reference numbers, swinging flap 24 is connected to casing 10 by hinge 26. This flap can thus be brought to a resting position, in which it is shown schematically in the form of broken lines and in which it masks the keyboard, and a position of use, in which it makes an obtuse angle with the casing (in the form of solid lines). Antenna 18 is contained in swinging flap 24. During use of the apparatus, it again projects downward from casing 10. This antenna can be executed in quite diverse ways, for example, by printing conductive tracks on a dielectric insulating substrate contained in the flap or constituting its back, by pattern impression or coating of conductors, by gluing on of a printed circuit, snapping on of a printed circuit, etc.

The flap can carry circuits other than the antenna, for example, a hybrid coupler, a low-pass filter, a bandpass filter, an antenna changeover, a multiplexing filter, etc. The hinge can have circuit breaking or switching means, allowing one to start and stop the apparatus, [or] to switch the circuits of antenna 18 to another antenna. The electrical connection between the electronic circuits contained in the casing and the antenna can occur by surface to surface contact of two disks, one attached to the flap and the other to the casing. The sliding contact has an assessable parasitic capacitance, which will be taken into account in order to match the impedance of the antenna to that of the electronic circuits. At the frequencies used, the loss of galvanic contact which oxidation of the contact surfaces of the disks can bring about has only a negligible effect, because of the capacitance of the capacitor constituted by the disks and because of the small distance between these disks.

In the case illustrated in Figure 3, casing 10 carries flap 28 which no longer swings, but rather is mounted so as to pivot around pin 30 so that it is made to project downward, as indicated in Figure 3, or brought back against the casing, as indicated by arrow f. As in the preceding case, the connection between antenna 18 and the circuits contained in the casing is effected flexible conductors or sliding contacts, and the flap can contain passive or active components and/or can bring about various switchings by its movement.

The embodiment variant shown in Figure 4 is differentiated from the preceding one in that flap 32 no longer swings or pivots but rather slides along the casing between a position of use in which it is shown in Figure 4 and a resting position in which, as in the preceding case, it can mask keyboard 34 and give the casing 10-flap 32 assembly a simple shape, for example, parallelipipedic, while protecting the keyboard. In this case, the connection between the antenna and the circuits can be effected by a flexible sheet carrying printed conductors.

Figures 5A to 6B show, as examples, forms of antennas which can be used on mobile flap 18. The choice of these shapes will in particular be made taking into account the available surface area.

Figures 5A-5C show symmetric antennas which can be executed by conventional techniques, such as photoetching.

Figure 5A shows a conventional dipole type antenna, having a length equal to $\lambda/2$, λ being a wavelength close to the wavelengths of transmission and receiving.

Figure 5B shows a variant of Figure 5A, consisting of a so-called trombone antenna. When the available space is small, it is possible to use a sinuous path of the branches of the antenna. Figure 5C shows that it is possible to limit the required space l_1 to a length much less than the half-wavelength. The path can be made even more sinuous when this is made necessary by the small amount of area available.

Figures 6A and 6B show examples of asymmetric antennas. Figure 6B in particular shows a case in which it is possible to reduce the longitudinal space requirement to a value l_2 which is clearly less than $\lambda/4$.

In particular, the equivalent electrical diagram of the apparatus can be that shown in Figure 7. Transmission-receiving electronic circuits 36 are connected to impedance matching transformer 38 by coaxial cable 40, having, for example, a characteristic impedance of 50 ohms. Transformer 38 ensures switching from the asymmetric circuit to the symmetric circuit and can have an output impedance of 200 symmetric ohms, compatible with the use of flexible sheet 42 carrying printed conductors 44. It is advantageous to use a sheet whose length is equal to $\lambda/2$ or to a multiple of $\lambda/2$, in order to take into account that it is more difficult to guarantee the characteristic impedance of a flexible sheet than of a coaxial cable or micro-ribbon cable. The flexible sheet is connected by impedance matching passive circuit 46 to antenna 18.

Claims

1. A transmitter-receiver apparatus which has casing (10) provided to be held with the hand, containing transmission-receiving circuits and carrying microphone (12) and earpiece (14) respectively placed in such a way as to be near the mouth and an ear in normal use position and containing the active electronic circuits for transmission-receiving at radio frequency, connected to an antenna, characterized by the fact that antenna (18) is placed in such a way as to project downward from casing (10) in normal use position.

2. An apparatus according to Claim 1, characterized by the fact that the antenna is of whip or telescopic type.

3. An apparatus according to Claim 1, characterized by the fact that the antenna is contained in flap (24,28,32) which pivots, swings or slides downward from its resting position to its normal use position.

4. An apparatus according to Claim 3, characterized by the fact that the flap contains passive antenna and interface circuits.

5. An apparatus according to any one of the preceding claims, characterized by the fact that it has a start switch controlled by bringing the antenna from its resting position to its normal use position.

6. An apparatus according to Claim 3 or to any one of the claims which depend on it, characterized by the fact that the flap is provided so as to mask control keyboard (34) when it is in resting position.

7. An apparatus according to any one of the preceding claims, characterized by the fact that transmission-receiving circuits (36) are connected to the antenna by the intermediary of impedance matching means, flexible sheet (42) or sliding contact, the antenna being of

symmetric or asymmetric type, [and are] produced by printing of conductive tracks, pattern impression or coating of conductors, or by gluing on of a printed circuit.

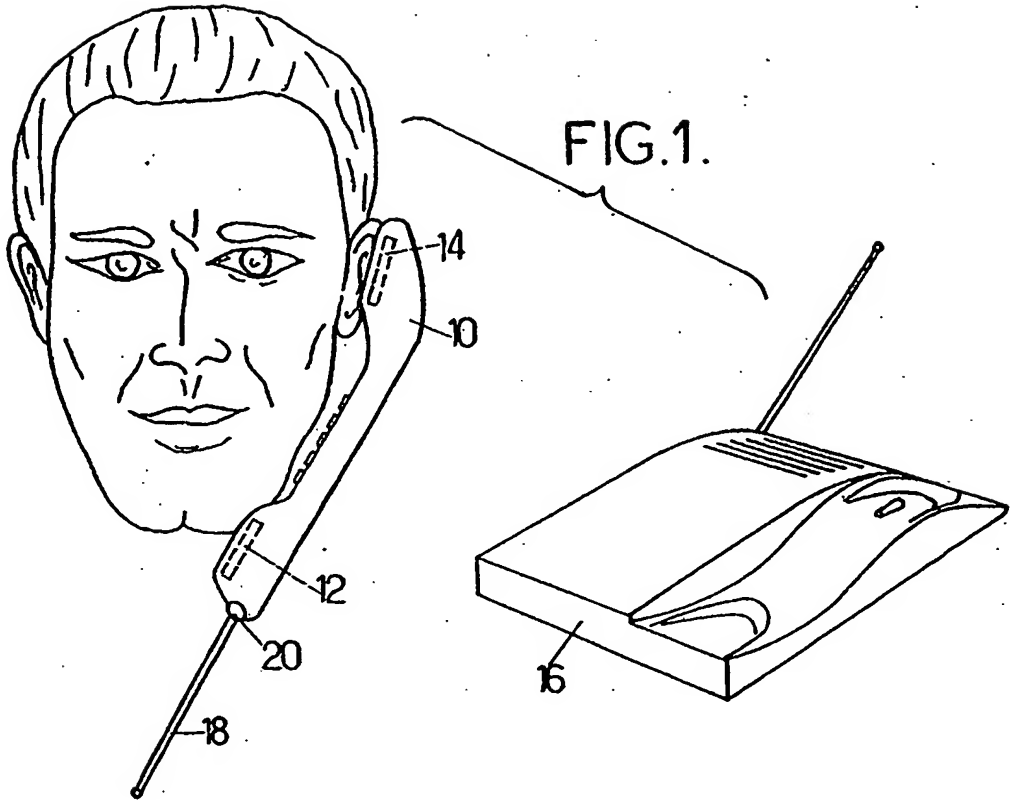


FIG.1.

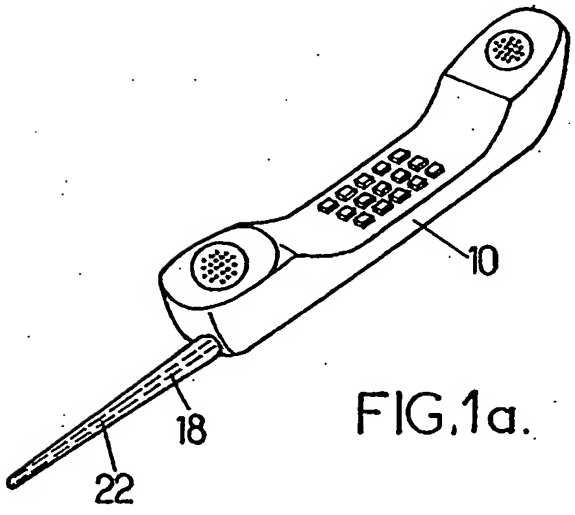


FIG.1a.

FIG.2.

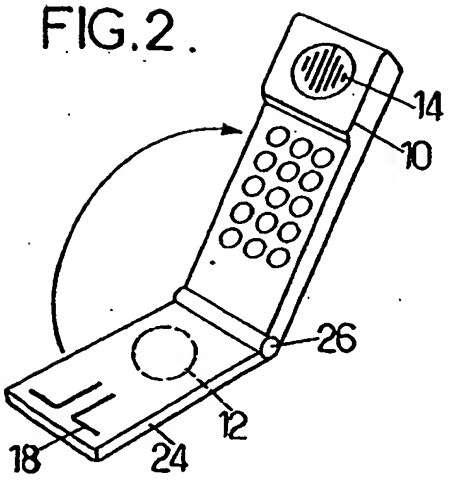


FIG.3.

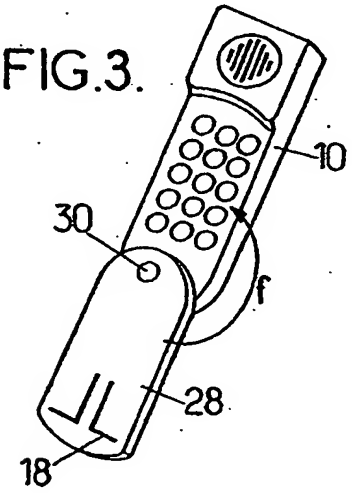
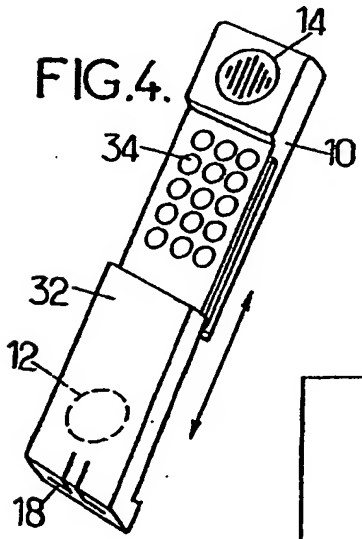


FIG.4.



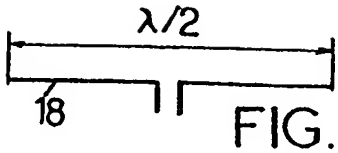


FIG.5A.

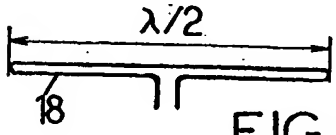


FIG.5B.

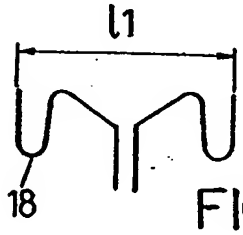


FIG.5C.

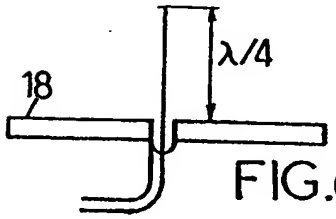


FIG.6A.

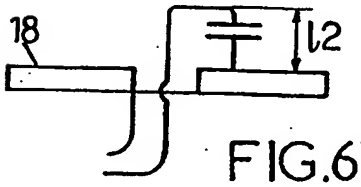
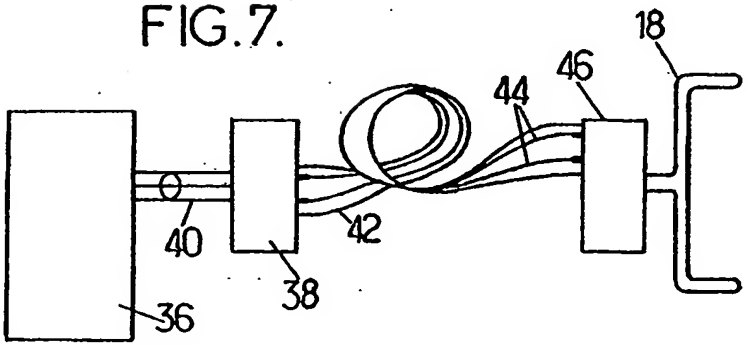


FIG.6B.

FIG.7.



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SEARCH REPORT
established on the basis of the most recent claims filed before the start of the search

DOCUMENTS CONSIDERED TO BE RELEVANT		Claims concerned in the examined document	
Category	Citation of document with indication where appropriate, of relevant passages		
X	EP-A-0 323 614 (MOTOROLA INC.) * Column 1, line 1 – column 3, line 20; Claims 1,4,9; Figures 1,2A *	1,3,6	
X	DE-A-1 930 531 (STANDARD ELEKTRIK LORENZ SEL AG) * Page 1, line 1 – line 11; Claims 1,2; Figure 1 * * Page 2, line 6 – page 3, line 1 *	1	
X	US-A-4 471 493 (SCHOBER) * Column 2, line 25 – column 3, line 5; Claims 1-3,9; Figure 2 *	1,3,5,6	
X	DE-A-3 309 832 (SIEMENS AG) * Page 3, line 5 – page 6, line 6; Claims 1,4,9; Figure 1 *	1,3,5,6	TECHNICAL FIELDS SEARCHED (Int. Cl.[5])
A	US-A-4 644 366 (SCHOLZ) * Figures 1,4,5 *	1,3,6	H04M H01Q H04B
A	DE-A-2 044 156 (ROBERT BOSCH ELEKTRONIK G.M.B.H.) * Page 8, line 4 – line 14; Figures 2,3 *	5	
A	GB-A-2 235 850 (THE PLESSEY COMPANY PLC) * Page 1, line 17 – page 2, line 2; Claims 1,2; Figures 3-5 *	6	
A	FR-A-2 539 233 (SOCIETE D'ETUDES, DE RECHERCHES, DE TRAVAUX D'ORGANISATION & GESTION) * Page 2, line 1 – line 7; Claims 1,4,5; Figure 1 *	5	
	DE-A-3 836 406 (ROBERT BOSCH G.M.B.H.) * Column 1, line 5 – line 48; Claims 1,5; Figures 1,3,4 *	5,6	
A	DE-A-3 401 518 (ANT NACHRICHTENTECHNIK G.M.B.H.) * Page 4, line 2 – page 5, line 16; Claims 1,4,5; Figures 1-3 *	1,3	

Date of completion of the search	Examiner
MARCH 16, 1992	DE HAAN A.J.

CATEGORY OF CITED DOCUMENTS

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